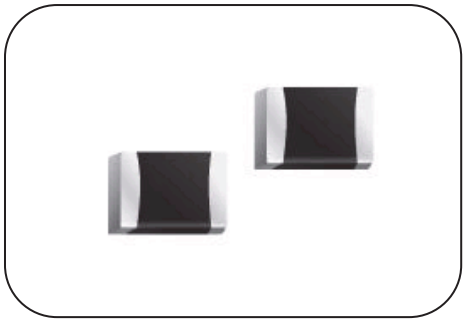
# NTC Thermistor：TSM Series

α Therm

## SMD Type NTC Thermistor for Temperature Sensing

### Features

1. RoHS & Halogen Free (HF) compliant
2. EIA size: 0201, 0402, 0603, 0805
3. Highly reliable structure
4. Operating temperature range: -40℃~+125℃
5. Wide resistance range
6. Cost effective
7. Agency recognition: UL / cUL / TUV



### Recommended Applications

1. Battery pack
2. Motherboard, notebook and personal computer device
3. Liquid crystal display
4. Cellular phone
5. Bluetooth headset
6. Wi-Fi module

### Part Number Code

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**Product Type**

| | |
|---|---|
| TSM | NTC Thermistor TSM Series |

**Size (EIA)**

| | |
|---|---|
| A | 0201 |
| 0 | 0402 |
| 1 | 0603 |
| 2 | 0805 |

**Definition of B Value**

| | |
|---|---|
| A | $B_{25/85}$ |
| B | $B_{25/50}$ |

**Zero Power Resistance at 25℃ ($R_{25}$)**

| | |
|---|---|
| 102 | $10x10^2\Omega$= 1 KΩ |
| 103 | $10x10^3\Omega$=10 KΩ |
| 473 | $47x10^3\Omega$= 47KΩ |

**Tolerance of $R_{25}$**

| | |
|---|---|
| F | ±1% |
| G | ±2% |
| H | ±3% |
| J | ±5% |
| K | ±10% |

**B Value**

| | |
|---|---|
| 338 | 3380 |
| 34D | 3435 |
| 395 | 3950 |
| 39H | 3975 |
| 405 | 4050 |

**Tolerance of B Value**

| | |
|---|---|
| 1 | ±1% |
| 2 | ±2% |
| 3 | ±3% |

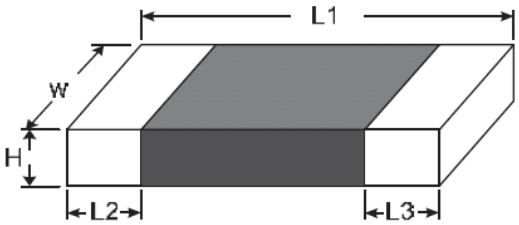
**Optional Suffix**

| | |
|---|---|
| Z | RoHS & HF Compliant |

**Packaging**

| | |
|---|---|
| R | Reel |
| B | Bulk |

### Structure and Dimensions




(Unit: mm)

| Part No. | Size | L1 | W | H max. | L2 & L3 |
|---|---|---|---|---|---|
| TSMA | 0201 | 0.60±0.05 | 0.30±0.05 | 0.35 | 0.15±0.05 |
| TSM0 | 0402 | 1.00±0.15 | 0.50±0.10 | 0.60 | 0.20±0.10 |
| TSM1 | 0603 | 1.60±0.15 | 0.80±0.15 | 0.95 | 0.40±0.15 |
| TSM2 | 0805 | 2.00±0.20 | 1.25±0.20 | 1.00 | 0.40±0.20 |

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### ■ Electrical Characteristics

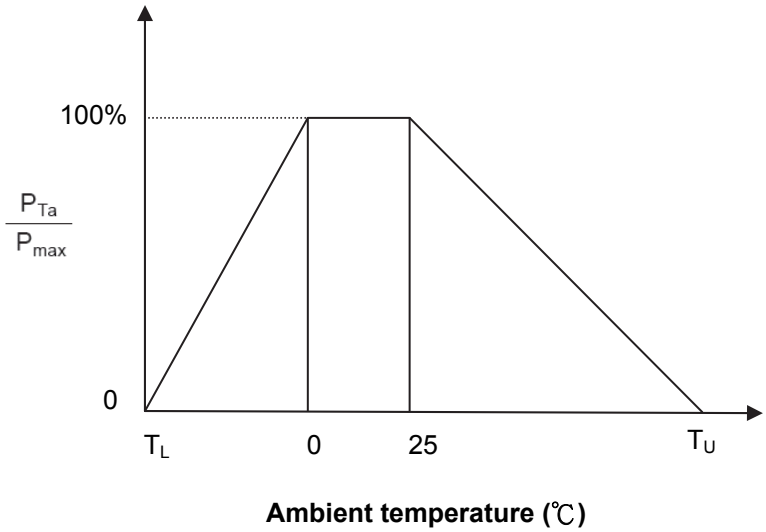
| Part No. | Size | Zero Power Resistance at 25°C | Tolerance of $R_{25}$ | B Value | | Tolerance of B value | Max. Power Dissipation at 25℃ | Dissipation Factor | Thermal Time Constant | Operating Temperature Range | Safety Approvals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | UL/ cUL | TUV | CQC |
| | | $R_{25}$(KΩ) | ( ±%) | (K) | | (±%) | $P_{max}$(mW) | δ(mW/°C) | τ (Sec.) | $T_L$~$T_U$(°C) | | | |
| TSMAB103□338* | 0201 | 10 | 1, 2, 3, 5, 10 | 25/50 | 3380 | 1, 2, 3 | 140 | Approx. 1.4 | Approx. 1.2 | -40 ~ +125 | √ | √ | √ |
| TSMAB683□425* | | 68 | | | 4250 | | | | | | √ | √ | √ |
| TSMAB104□425* | | 100 | | | 4250 | | | | | | √ | √ | √ |
| TSM0A103□34D* | 0402 | 10 | 1, 2, 3, 5, 10 | 25/85 | 3435 | 1, 2, 3 | 170 | Approx. 1.7 | Approx. 2.0 | -40 ~ +125 | √ | √ | √ |
| TSM0A103□395* | | 10 | | | 3950 | | | | | | √ | √ | √ |
| TSM0A223□395* | | 22 | | | 3950 | | | | | | √ | √ | √ |
| TSM0A333□405* | | 33 | | | 4050 | | | | | | √ | √ | √ |
| TSM0A683□410* | | 68 | | | 4100 | | | | | | √ | √ | √ |
| TSM0A104□405* | | 100 | | | 4050 | | | | | | √ | √ | √ |
| TSM0A104□436* | | 100 | | | 4360 | | | | | | √ | √ | √ |
| TSM0B103□338* | | 10 | | 25/50 | 3380 | | | | | | √ | √ | √ |
| TSM0B473□405* | | 47 | | | 4050 | | | | | | √ | √ | √ |
| TSM0B104□354* | | 100 | | | 3540 | | | | | | √ | √ | √ |
| TSM0B104□480* | | 100 | | | 4800 | | | | | | √ | √ | √ |
| TSM0B224□470* | | 220 | | | 4700 | | | | | | √ | √ | √ |
| TSM0B474□470* | | 470 | 5, 10 | | 4700 | 3 | | | | | √ | √ | √ |
| TSM1A202□340* | 0603 | 2 | 1, 2, 3, 5, 10 | 25/85 | 3400 | 1, 2, 3 | 210 | Approx. 2.1 | Approx. 3.1 | -40~+125 | √ | √ | √ |
| TSM1A472□34D* | | 4.7 | | | 3435 | | | | | | √ | √ | √ |
| TSM1A472□370* | | 4.7 | | | 3700 | | | | | | √ | √ | √ |
| TSM1A502□34D* | | 5 | | | 3435 | | | | | | √ | √ | √ |
| TSM1A502□385* | | 5 | | | 3850 | | | | | | √ | √ | √ |
| TSM1A682□34D* | | 6.8 | | | 3435 | | | | | | √ | √ | √ |
| TSM1A682□395* | | 6.8 | | | 3950 | | | | | | √ | √ | √ |
| TSM1A103□34D* | | 10 | | | 3435 | | | | | | √ | √ | √ |
| TSM1A103□39H* | | 10 | | | 3975 | | | | | | √ | √ | √ |
| TSM1A103□430* | | 10 | 5, 10 | | 4300 | 3 | | | | | √ | √ | √ |
| TSM1A223□392* | | 22 | 1, 2, 3, 5, 10 | | 3920 | 1, 2, 3 | | | | | √ | √ | √ |
| TSM1A473□39H* | | 47 | | | 3975 | | | | | | √ | √ | √ |
| TSM1A683□39H* | | 68 | | | 3975 | | | | | | √ | √ | √ |
| TSM1A104□405* | | 100 | | | 4050 | | | | | | √ | √ | √ |
| TSM1A104□436* | | 100 | | | 4360 | | | | | | √ | √ | √ |
| TSM1A154□406* | | 150 | | | 4060 | | | | | | √ | √ | √ |
| TSM1A204□410* | | 200 | | | 4100 | | | | | | √ | √ | √ |
| TSM1A474□415* | | 470 | | | 4150 | | | | | | √ | √ | √ |
| TSM1B221□350* | | 0.22 | 5, 10 | 25/50 | 3500 | 3 | | | | | √ | √ | √ |
| TSM1B222□395* | | 2.2 | | | 3950 | | | | | | √ | √ | √ |
| TSM1B472□425* | | 4.7 | | | 4250 | | | | | | √ | √ | √ |
| TSM1B103□338* | | 10 | 1, 2, 3, 5, 10 | | 3380 | 1, 2, 3 | | | | | √ | √ | √ |
| TSM1B103□420* | | 10 | | | 4200 | | | | | | √ | √ | √ |
| TSM1B104□355* | | 100 | | | 3550 | | | | | | √ | √ | √ |
| TSM1B224□460* | | 220 | | | 4600 | | | | | | √ | √ | √ |
| TSM2A 502□34D* | 0805 | 5 | 1, 2, 3, 5, 10 | 25/85 | 3435 | 1, 2, 3 | 240 | Approx. 2.4 | Approx. 5.4 | -40~+125 | √ | √ | √ |
| TSM2A103□34D* | | 10 | | | 3435 | | | | | | √ | √ | √ |
| TSM2A103□395* | | 10 | | | 3950 | | | | | | √ | √ | √ |
| TSM2A473□39H* | | 47 | | | 3975 | | | | | | √ | √ | √ |
| TSM2A104□405* | | 100 | | | 4050 | | | | | | √ | √ | √ |
| TSM2A684□450* | | 680 | 5, 10 | | 4500 | 3 | | | | | √ | √ | √ |

Note 1: □ = Tolerance of $R_{25}$

* = Tolerance of B value

Note 2: Special specifications are available upon request

### ■ Max. Power Dissipation Derating Curve




$T_U$ : Maximum operating temperature (℃)

$T_L$ : Minimum operating temperature (℃)

For example:

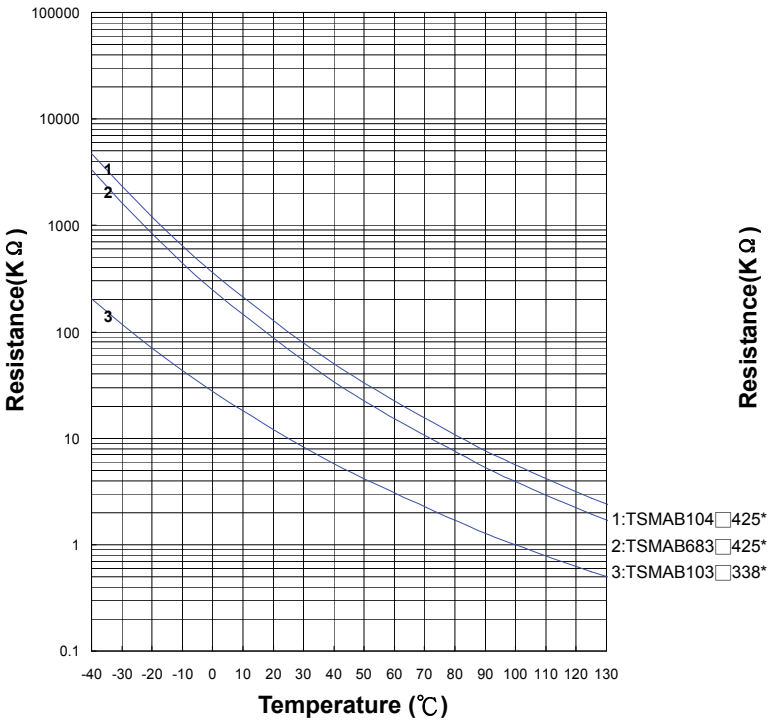
Ambient temperature (Ta) = 55℃

Maximum operating temperature ($T_U$) = 125℃

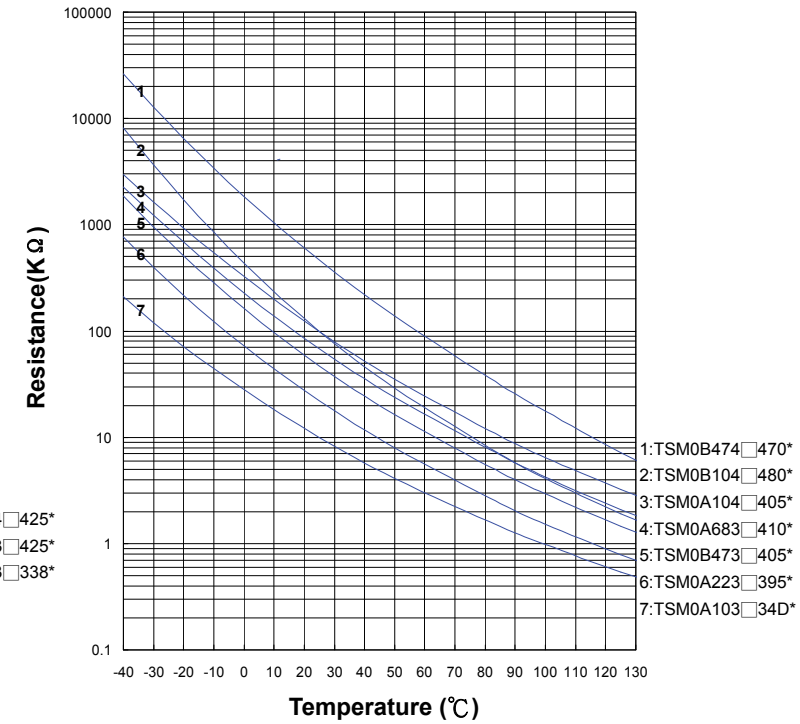
$P_{Ta}=(T_U-Ta)/(T_U-25)\times Pmax$ = 70% Pmax

### ■ R-T Characteristic Curves

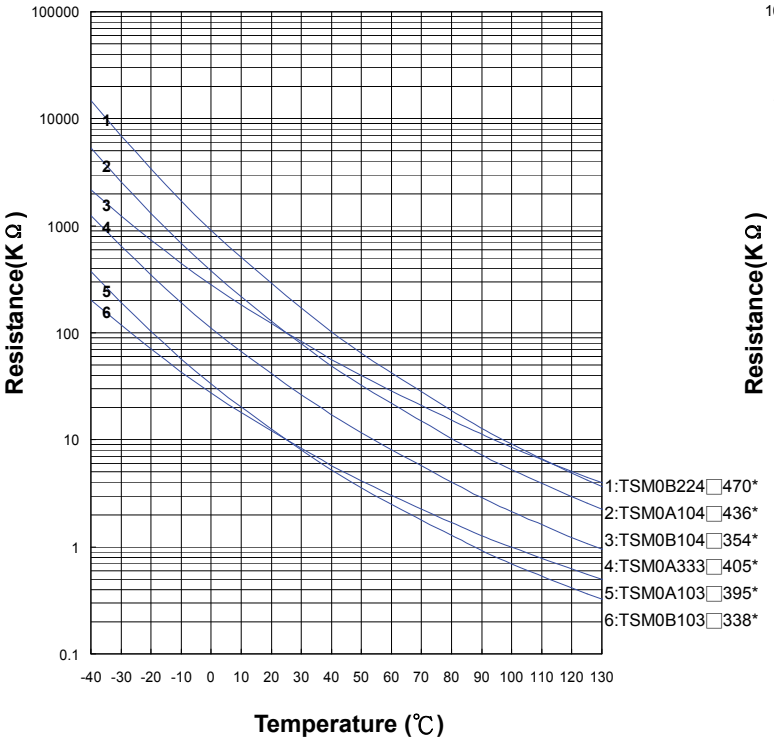
TSMAB103□338* ~ TSMAB104□425*



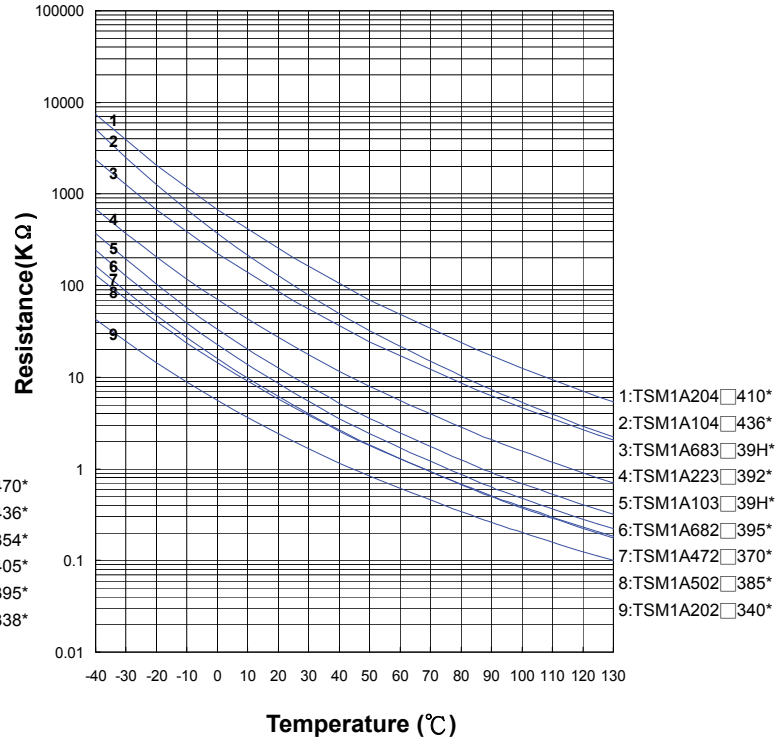

TSM0A103□34D* ~ TSM0B474□470*



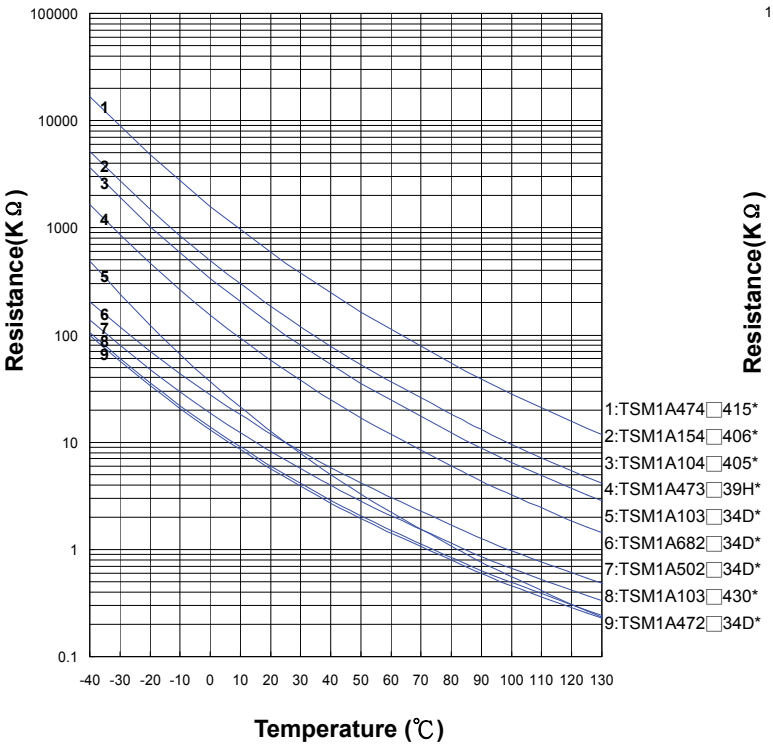
TSM0B103□338* ~ TSM0B224□470*



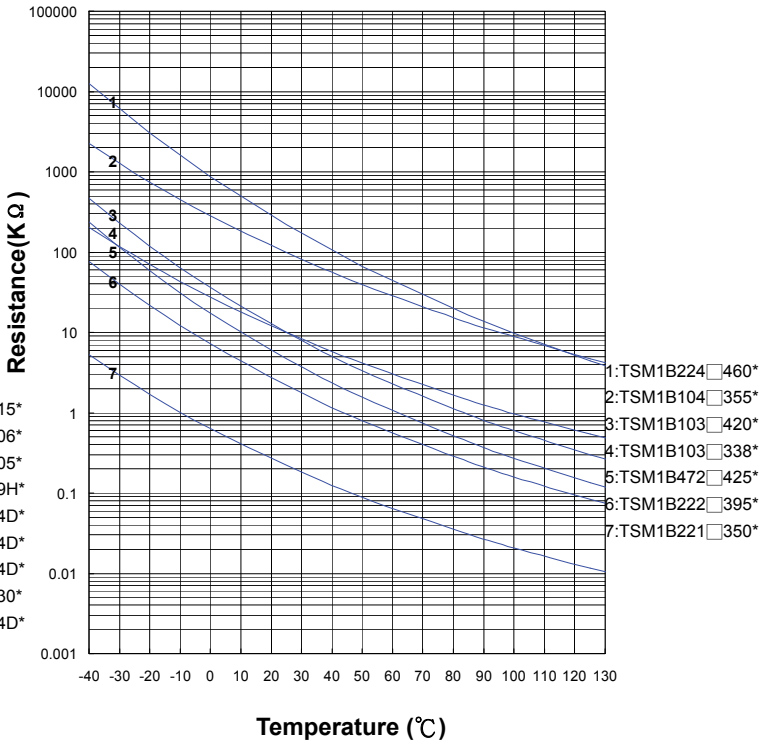

TSM1A202□340* ~ TSM1A204□410*

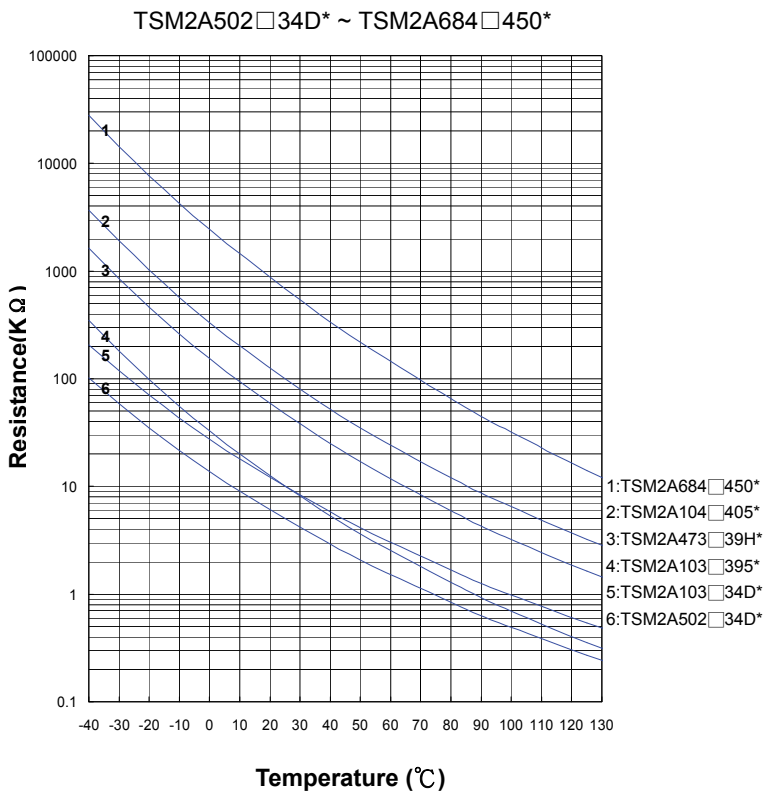



TSM1A472□34D* ~ TSM1A474□415*



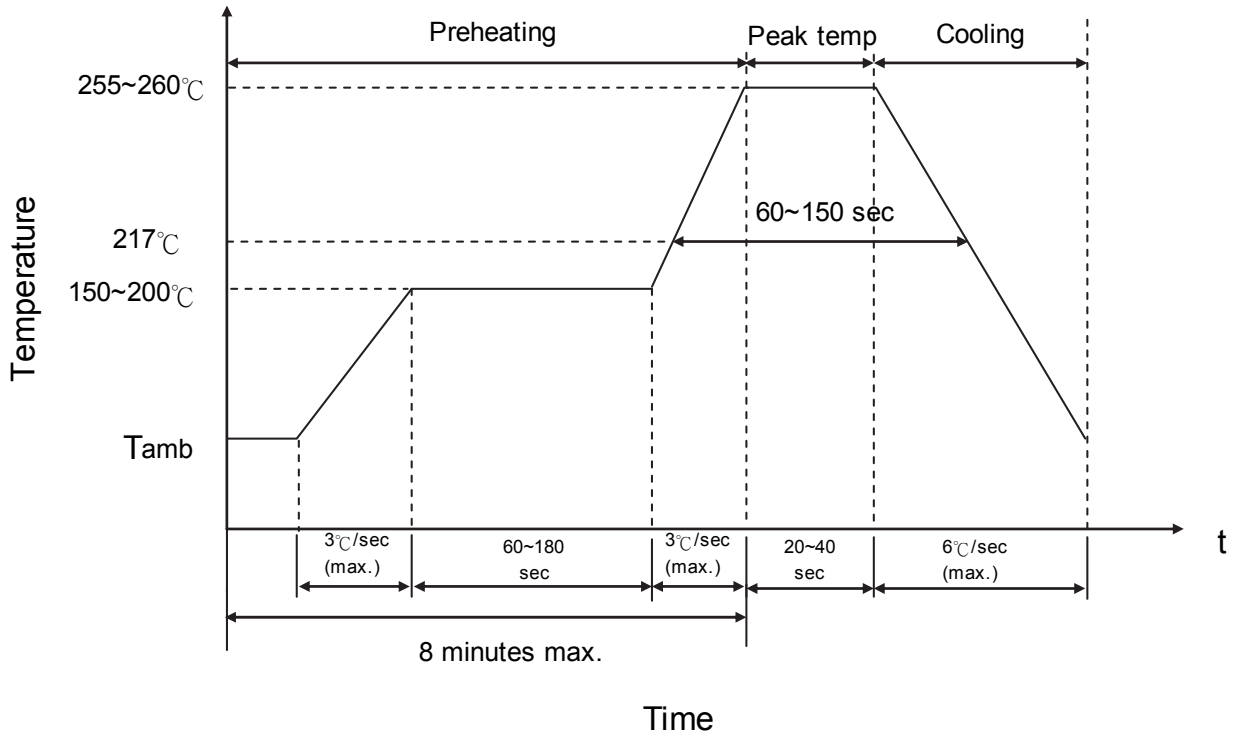

TSM1B221□350* ~ TSM1B224□460*






## ■ Soldering Recommendation

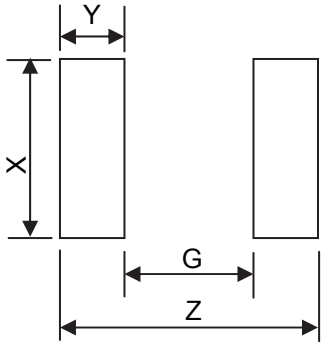
### ● IR-reflow Soldering Profile



- **Recommended Reworking Conditions with Soldering Iron**

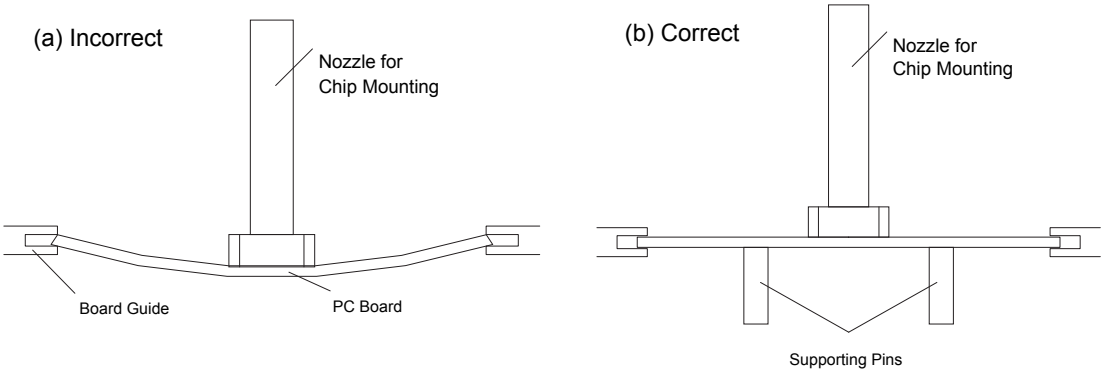
| Item | Conditions |
|---|---|
| Temperature of Soldering Iron-tip | 360℃ (max.) |
| Soldering Time | 3 sec. (max.) |
| Diameter of Soldering Iron-tip | Φ3mm (max.) |
| Caution: Please do not touch the component surface with soldering iron directly to avoid its damage. | |

■ **Recommended Soldering Pad Dimensions**

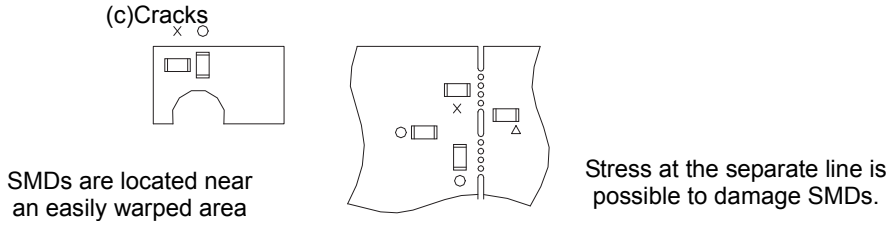



| Size | Z (mm) | G (mm) | X (mm) | Y (mm) |
|---|---|---|---|---|
| 0201 | 0.8 | 0.3 | 0.3 | 0.25 |
| 0402 | 1.7 | 0.5 | 0.6 | 0.6 |
| 0603 | 3.0 | 1.0 | 1.0 | 1.0 |
| 0805 | 3.4 | 1.0 | 1.4 | 1.2 |

### ■ Notice of Soldering and Mounting on PC Board

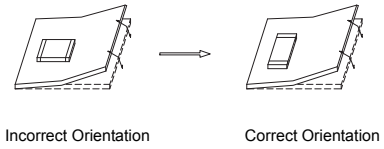



For mounting SMDs on a PC board, supporting pin is suggested for use (refer to figure b) to avoid cracks caused by external stress (refer to figure a).




If circuit bending is needed for PC board design, please refer to figure (c) for mounting positions to avoid cracks caused by stress imposed on the product. O means better, △ is acceptable, and X is worst.

(d) Component Orientation




Locate SMDs horizontally to the direction that stress acts

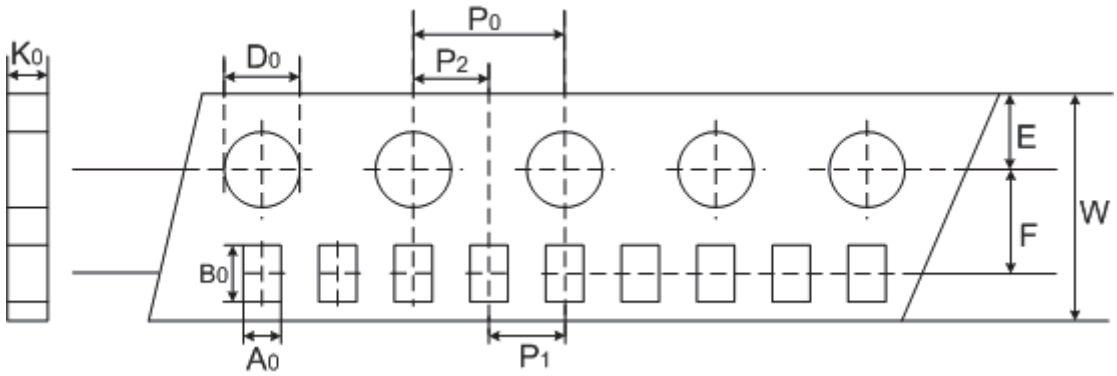
During circuit bending, please locate SMDs horizontally to the direction in which stress act to avoid its cracks (refer to figure d).

### ■ Reliability

| Item | Standard | Test conditions / Methods | Specifications |
|---|---|---|---|
| Bending Strength | IEC 60068-2-21 | Warp : 2mm for 0402,0603 and 0805<br>1mm for 0201<br>Speed ＜ 0.5mm/sec.<br>Duration: 10 sec. on PCB | No visible damage<br>$\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$ |
| Solderability | IEC 60068-2-58 | 245 ± 5℃, 3 ± 0.3 sec. | At least 95% of terminal electrode is covered by new solder |
| Resistance to Soldering Heat | IEC 60068-2-58 | 260 ± 5℃, 10 ± 1 sec. | No visible damage<br>$\lvert \triangle R_{25}/R_{25} \rvert \leqq 3\ \%$ |
| High Temperature Storage | IEC 60068-2-2 | 125 ± 5℃, 1000 ± 24 hrs | No visible damage<br>$\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$ |
| Damp Heat, Steady State | IEC 60068-2-78 | 40 ± 2℃, 90~95% RH , 1000 ± 24 hrs | No visible damage<br>$\lvert \triangle R_{25}/R_{25} \rvert \leqq 3\ \%$ |
| Rapid Change of Temperature | IEC 60068-2-14 | The conditions shown below shall be repeated 5 cycles on PCB.<br><br>Step / Temperature (℃) / Period (minutes)<br>1 / -40 ± 5 / 30 ± 3<br>2 / Room temperature / 5 ± 3<br>3 / 125 ± 5 / 30 ± 3<br>4 / Room temperature / 5 ± 3 | No visible damage<br>$\lvert \triangle R_{25}/R_{25} \rvert \leqq 3\ \%$ |
| Max. Power Dissipation | IEC 60539-1 | 25 ± 5℃, Pmax. , 1000 ± 24 hrs | No visible damage<br>$\lvert \triangle R_{25}/R_{25} \rvert \leqq 5\ \%$ |

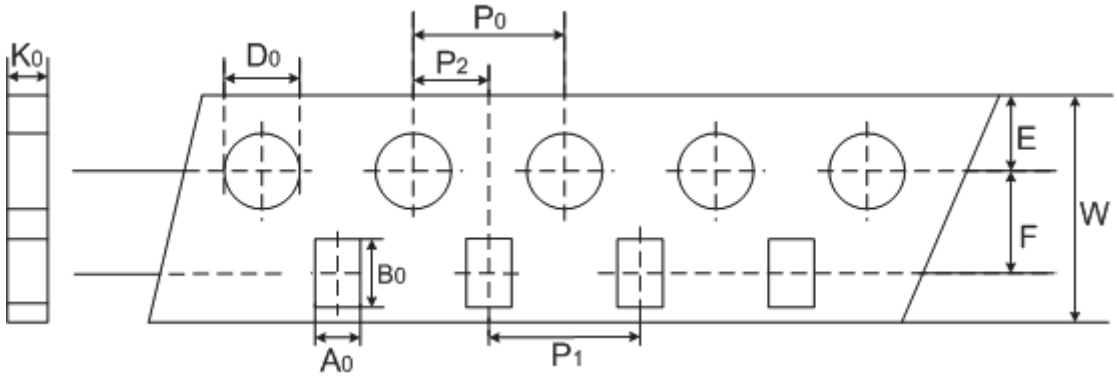
### ■ Package

● **Taping Specification**




(Unit: mm)

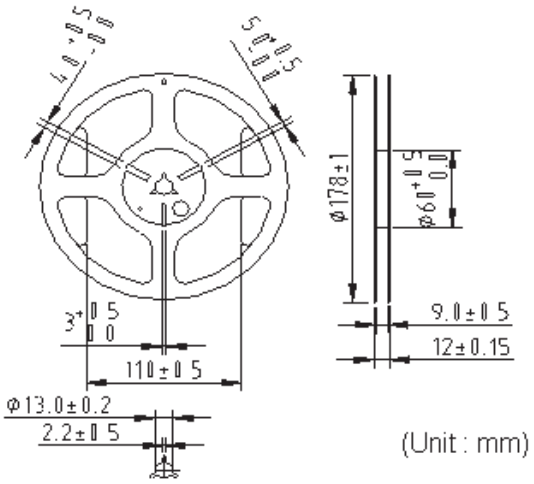
| Index / Size | $A_0$ ±0.05 | $B_0$ ±0.12 | W ±0.2 | E ±0.1 | F ±0.05 | $P_1$ ±0.1 | $P_2$ ±0.05 | $P_0$ ±0.1 | $D_0$ ±0.1 | $K_0$ ±0.1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0201 | 0.38 | 0.68 | 8 | 1.75 | 3.5 | 2 | 2 | 4 | 1.55 | 0.38 |
| 0402 | 0.62 | 1.12 | 8 | 1.75 | 3.5 | 2 | 2 | 4 | 1.55 | 0.60 |




(Unit: mm)

| Index / Size | $A_0$ ±0.2 | $B_0$ ±0.2 | W ±0.2 | E ±0.1 | F ±0.05 | $P_1$ ±0.1 | $P_2$ ±0.05 | $P_0$ ±0.1 | $D_0$ ±0.1 | $K_0$ ±0.1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0603 | 1.1 | 1.9 | 8 | 1.75 | 3.5 | 4 | 2 | 4 | 1.55 | 0.95 |
| 0805 | 1.5 | 2.3 | 8 | 1.75 | 3.5 | 4 | 2 | 4 | 1.55 | 1.0 |

### ■ Quantity




| Size | Quantity (pcs/reel) |
|---|---|
| 0201 | 15,000 |
| 0402 | 10,000 |
| 0603 | 4,000 |
| 0805 | 3,500 |

### ■ Warehouse Storage Conditions of Products

- Storage Conditions :
  1. Storage Temperature: -10℃~+40℃
  2. Relative Humidity: ≦75%RH
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage : 1 year